Faculty of Cognitive Sciences and Human Development

JOYSTICK AS INPUT DEVICE FOR INTERACTION IN AUGMENTED REALITY

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JOYSTICK AS INPUT DEVICE FOR INTERACTION IN AUGMENTED REALITY

CHAI LE KEAN

This project is submitted in partial fulfilment of the requirements for a
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The project entitled 'Joystick as Input Device for Interaction in Augmented Reality' was prepared by Chai Le Kean and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Bachelor of Science with Honours Cognitive Science

Received for examination by:

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Statement of Originality

The work described in this Final Year Project, entitled
"Joystick as Input Device for Interaction in Augmented Reality"
is to the best of the author's knowledge that of the author except
where due reference is made.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

JOYSTICK AS INPUT DEVICE FOR INTERACTION IN AUGMENTED REALITY

Chai Le Kean

Joysticks are dedicated tool available for three dimension controlling and can be analogue. Therefore, using joystick as input device for interaction in augmented reality (AR) system can increase the interaction in AR applications. This project allowed the user to interact with virtual objects by using joystick.

ABSTRAK

JOYSTIK SEBAGAI PERANTI INPUT UNTUK INTERAKSI DALAM AUGMENTED REALITY

Chai Le Kean

Joystik adalah peranti input yang berdedikasi untuk pengawalan tiga dimensi dan dapat dianalogkan. Oleh itu, menggunakan joystik sebagai peranti input untuk interaksi dalam 'augmented reality' (AR) sistem boleh meningkatkan interaksi dalam aplikasi AR. Projek ini membenarkan pengguna berinteraksi dengan objek maya dengan menggunakan joystik.

CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter discusses the background, problem statements, objectives of study, contribution and the scope of the study.

1.1 Background

Game interaction techniques are based on real movements and are important parts of the game concept. New interaction techniques and graphical representation are required to achieve those natural and intuitive types of controlling a game for example augmented reality (AR) (Geiger, Klompmaker, Stoecklien, Fritze, 2007). Augmented reality techniques are very suitable to integrate computer-generated content seamlessly in the real world.

A number of AR games have been proposed in recent years and one of the first AR games was ARQuake (Thomas, Close, Donoghue, Squires, De Bondi, Morris & Piekarski, 2002). ARQuake is an application of the *Quake* software from *idSoftware* in the field of AR. In this application, the user navigates in physical environment by walking. The opponents are augmented into the surroundings. The user interacts by using prop pistol developed by researchers.

The developed device has the force feedback effect when firing the weapon or when the user was hit by the opponent (Piekarski & Thomas, 2002).

Besides of involving AR applications in games field, AR also have contribution in biological industry (Li, Xi, Yu & Fung, 2003a) and construction industry (Moon, Son, Park & Kim, 2007). Both applications used joystick as input device for interacting with AR system. This gives additional visual feedback to help the construction operator navigate easily and control the robot. The nanomanipulation in biological industry use joystick to control the cantilever tip interaction.

1.2 Problem Statement

Interactive gaming is becoming one of the dominant application areas for computer graphic (Szalavari, Eckstein & Gervautz, 1998). The usage of input devices in AR games can increase the interaction in AR games. For example, war games simulation system. The participant could see a helicopter rising above the tree line. This helicopter could be flown in simulation by another participant (Metzger, 1993 as cited in Vallino, 1998). The navigation of helicopter in simulation system is manipulated by input device. Although the keyboard can be used to navigate in three dimensions, it is not designed for gaming, so it lacks both intuitive and analogue control (Eric, Paul & Mark, 2003). Therefore, the joysticks are dedicated tool use for three dimension gaming and can be analogue (Eric, Paul & Mark, 2003).Thus, the objectives of the present study were discussed as followed.

1.3 Objectives of Study

The objectives are divided into two categories which are general objective and specific objective.

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1.3.1 General Objective

The objective of the study is using joystick to control the virtual object in augmented reality system.

1.3.2 Specific Objective

The specific objective of this study is to implement joystick as input device for interaction in augmented reality system and to control the virtual object in real time.

1.4 Contributions

This project allows the user to interact with the virtual object in real environment. The user can interact with the virtual object by using the joystick as an input device and receive visual feedback when the virtual object is navigated and rotated in the scene. These can enhance the interaction technique in the AR system and enrich the implementation of input device in AR system. This can also contribute to other application of AR field which involve the interaction with virtual object such as games, education, exhibition and so on.

1.5 Project Scope

The scope of this project is to implement the joystick as input device for interacting with virtual object in augmented reality system. Users can control the can manipulate the virtual object in the system by using joystick.

1.6 Values of Study

The potential of using AR is to enhance the user perception of the world around and boost their interaction (Augmented Reality, n.d.). Since AR provides

safe environment, it can be used by everybody. This system proposes a new dimension in game field. It allows user to have more enjoyable environment for playing game.

1.7 Significance of the Study

The significance of the study is to increase the interaction technique in the AR system and also enrich the implementation of input device in AR system.

1.8 Structure of the Thesis

This paper contains five chapters that were explaining and discussing the element taken in the process of development of this system. This paper starts with Chapter One, which established the research topic and background information of the project. The overview of the literature was discussed in Chapter Two while Chapter Three will discuss the research metbodology and system design of this project. Chapter Four included the development of this project. Finally, conclusion and future work of this study was discussed in chapter five.

1.9 Summary

The overview of this project had been introduced in this chapter. The discussions included the background, problem statement, objectives, contribution and scope, values and significance and also the structure of this project. The following chapter will discuss about the literature review of this project.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter reviews the joystick as input devices for interaction in augmented reality (AR) application and other interactive input devices in AR system.

2.1 Joystick as Input Device for Interaction in Augmented Reality Application

Input device was developed to allow the user to operate within 2D and 3D environments in computer generated system by moving and rotating the virtual object (Thad, Bastian, Brad, Kent, Maribeth, & Jarrell, 2000). There are many implementation of joystick in AR system. The following are the AR applications that were implemented witb joystick.

2.1.1 Augmented Reality System for Real-time Nanomanipulation

Atomic force microscopy (AFM) is an instrument used for surface science research (Binning, Quate & Gerber, 1986). The AFM have employed to modify surfaces and manipulate nano-size structure (Li, Xi, Yu & Fung, 2003b). The problem of nanomanipulation by using AFM is the operator does not have real time information feedback during manipulation. Therefore, AR system is implemented in the nanomanipulation using AFM in order to give real-time visual feedback based on the force information of the operator during performing manipulation (Li, Xi, Yu & Fung, 2003a).

Haptic joystick used to obtain and feed the normal force and lateral force to analyze the cantilever-tip forces. Both the tip motion and joystick motion are rendered on the operating environment in real time. The operator can control the tip motion through the joystick and view the tip movements from the operating environment and also feeling the force from the joystick and seeing the changes of environment in real time (Li, Xi, Yu & Fung, 2003b). This allows the operator to generate manipulation paths quickly, make rapid control decisions based on force and visual feedback, and also adjust the paths in real time to ensure sufficient contact force without harming the object under manipulation.

The position control of cantilever tip is by mapping the position information of the joystick to the AFM piezo-tube, the cantilever tip can be controlled to move on or above the sample surface (Li, Xi, Yu & Fung, 2003a). The position control algorithm was further discussed in the paper of "Augmented Reality System for Real-time Nanomanipulation" (Li, Xi, Yu & Fung, 2003a).